

Paper
Presented to the
American Association for
the Advancement of Science
Session on General System Theory

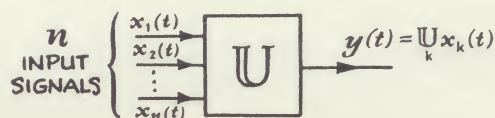
Washington, D.C.
December 29, 1958

Ordering and Selection Processes and Ultra-Reliable Systems

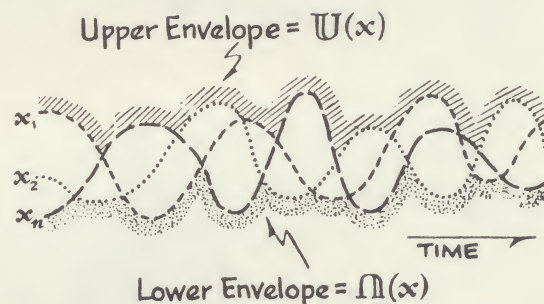
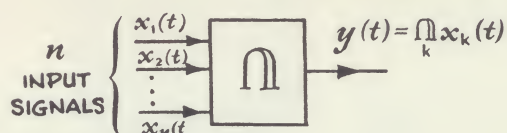
H.M. Paynter
Massachusetts Institute of Technology
Cambridge, Massachusetts
American Center for Analog Computing
Boston, Massachusetts

SELECTION as a PROCESS

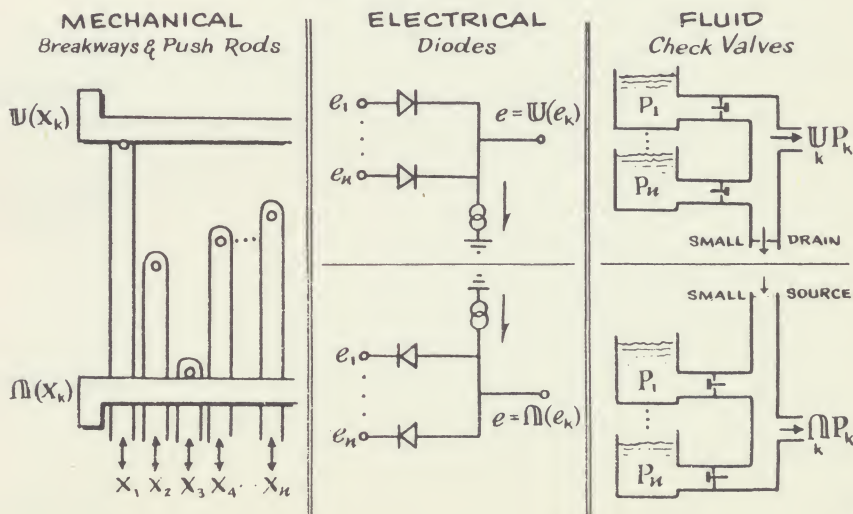
UPPER SELECTOR



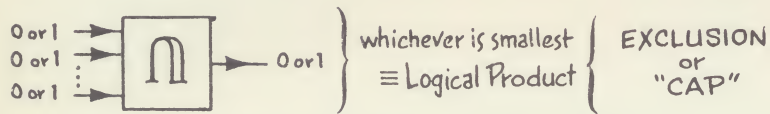
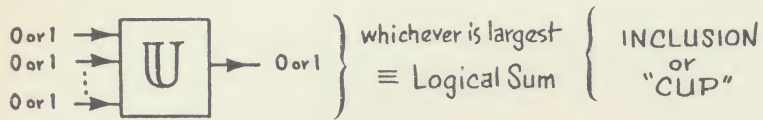
LOWER SELECTOR



GENERATION of SELECTION OPERATIONS Following George A. Philbrick

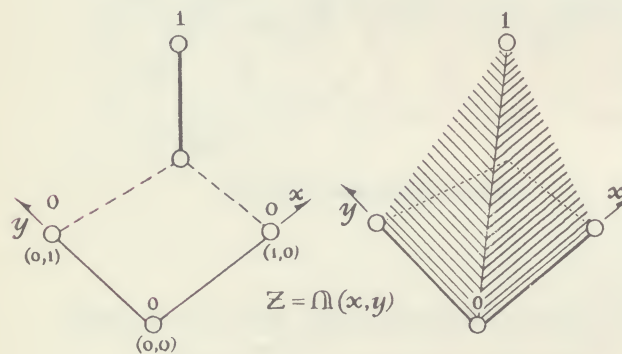
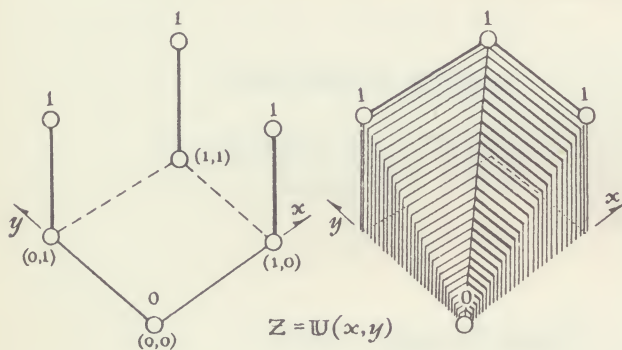


APPLICATION to BINARY SIGNALS & RELAY SYSTEMS



BINARY LOGIC

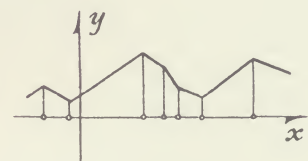
CONTINUOUS LOGIC



CONTINUOUS FUNCTIONS (As manufactured by Philbrick Researches)

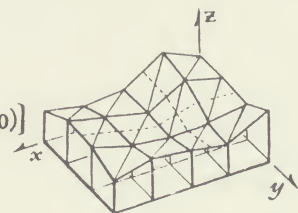
One Variable

$$y = \sum_i a_i U[\cap(x - X_i), 0]$$



Two Variables

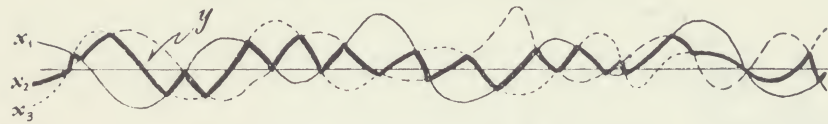
$$Z = \sum_{ij} a_{ij} U[\cap(x - X_i, y - Y_j), 0]$$



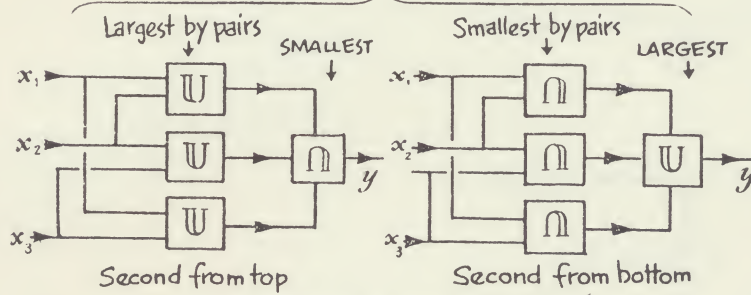
n-Variables

$$u = \sum_{i,j,k,\dots} a_{ij,k,\dots} U[\cap(x_1 - X_{1i}, x_2 - X_{2j}, x_3 - X_{3k}, \dots, 0)]$$

SELECTION of CONTINUOUS MEDIAN SIGNAL Special Case of Three Signals



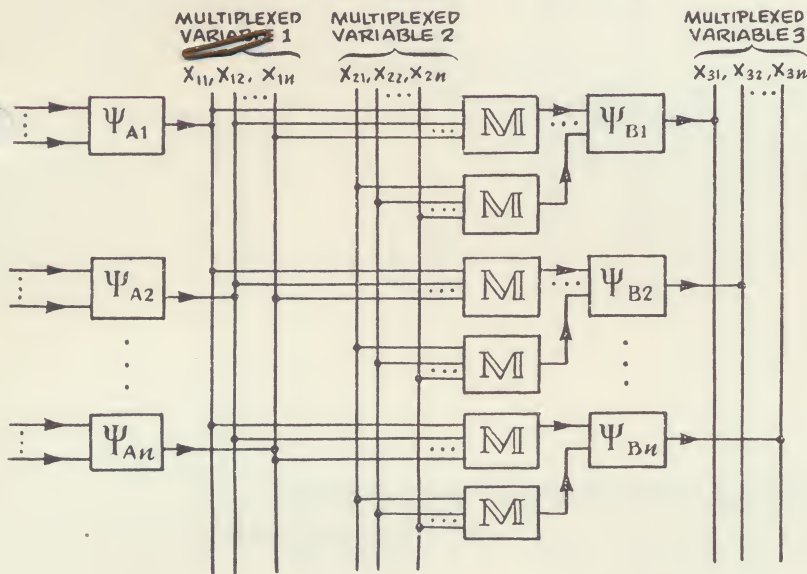
DUAL OPERATORS



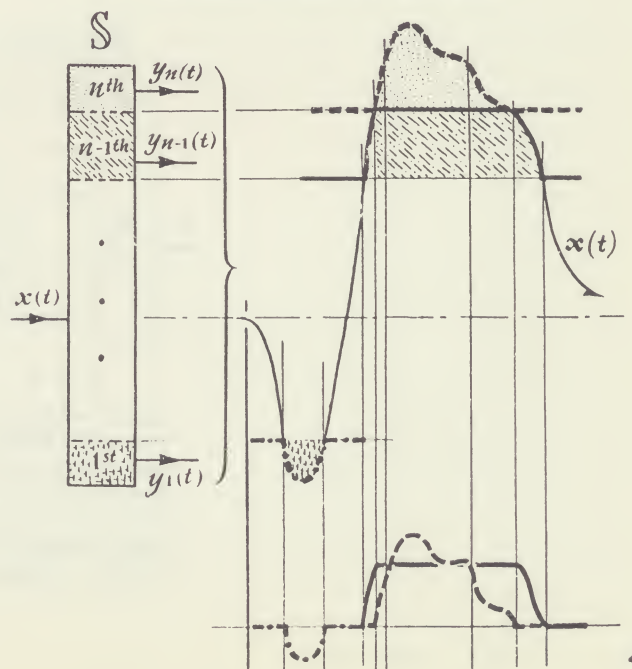
Can be generalized to

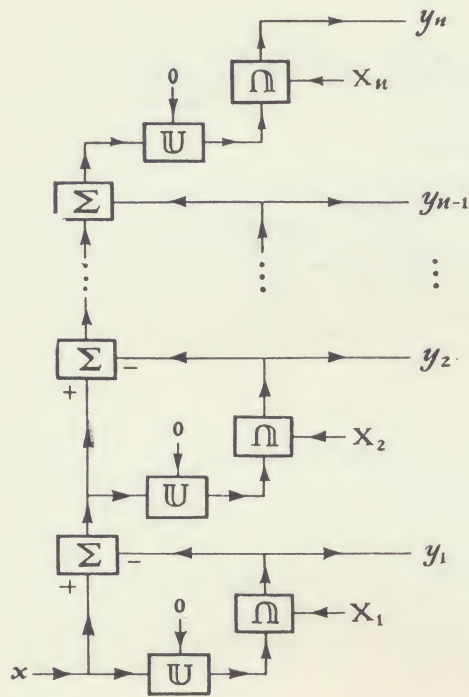


ULTRA-RELIABLE SYSTEMS

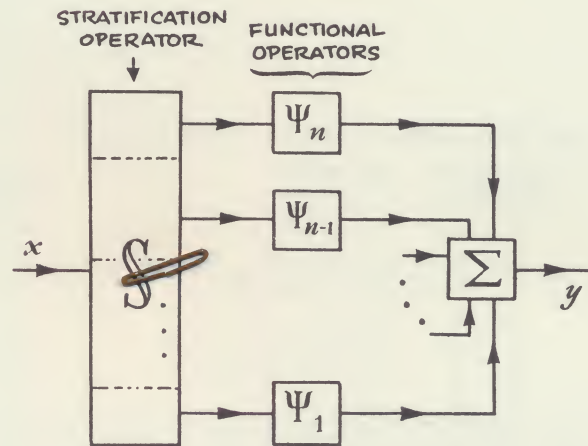


ORDERING or STRATIFICATION OPERATOR Decomposes into n -Strata

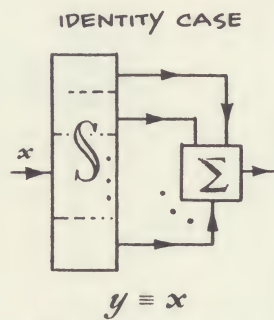




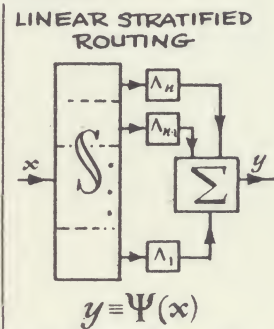
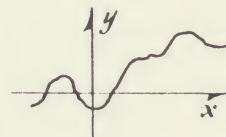
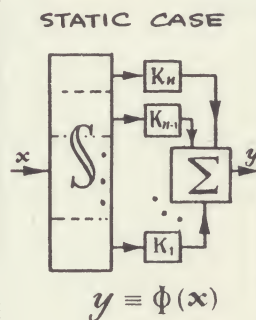
STRATIFIED FUNCTIONALS



EXAMPLES of STRATIFIED ROUTING



Except when one or more channels fail; then system has certain elements of high reliability, since it includes analog and digital transmission as special cases.



Interesting Special Case:

$$\Lambda_k = \frac{K_k}{\tau_k D + 1}; \quad D = \frac{d}{dt}$$

$K_k: 0 \rightarrow 1$ with increasing k
 $\tau_k: \infty \rightarrow 0$ " " "